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Voluntary Intake and Performance of Wad Sheep Fed Ensiled Cassava Tops and Guinea Grass Mixture

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A study was conducted to assess the effect of feeding ensiled Cassava tops(CT) and Guinea Grass(GG) mixture with four energy additives on the voluntary dry matter intake and performance of WAD sheep. The silage were combined in ratio 3:6:1 in five treatments: 1 (GG + CT + cassava chips), 2 (GG + CT + Sorghum), 3 (GG + CT + millet grains), 4 (GG + CT + sugar) and 5 (GG + CT + no additive After 42 days of ensiling, chemical composition: Dry Matter (DM), CP, ash, Neutral Detergent Fibre (NDF), and Acid Detergent Fibre (ADF) were determined. In a completely randomised design, 25 WAD sheep were fed with the five silages for 135 days to evaluate Dry Matter Intake (DMI), Daily Weight Gain (DWG), Dry Matter Digestibility (DMD). Dry Matter (27.1-28.8%), CP (21.8-24.9%), ash (7.6-9.4%), NDF (68.8-71.7%) and ADF (40.6-48.1%) of the silages differed significantly among treatments. Result showed that Dry Matter (27.1-28.8%), CP (21.8-24.9%), ash (7.6-9.4%), NDF (68.8-71.7%) and ADF (40.6-48.1%) of the silages differed significantly among treatments. The DMI (472.6-530.0 g/d) and DMD (75.8-84.7%) differed significantly while DWG was similar among treatments. Cassava tops and Guinea grass ensiled with all additives used, had good silage properties and enhanced voluntary intake, promote efficient nutrient utilization and performance by WAD sheep.

Keywords: Cassava tops, Nutritive value, Voluntary intake, Dry matter intake, West African Dwarf rams.

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INTRODUCTION

Ruminant livestock production is mainly carried out by small holders who are largely dependent on natural forages for their feed resources. Natural forages grow freely along the road and on idle agricultural land. Green forages are plentiful during the rainy season. However, during the dry season, grasses for livestock will become a problem. The tedious daily harvesting of green forages at far distances throughout the year also poses problems for small-scale producers, particularly when family labour is insufficient (Aminah *et al*., 1999) and cost of hired labour is exorbitant. Fodder conservation is promoted with main objective of ensuring feed availability during periods of feed limitations. The dearth of fresh forages in the dry season in Nigeria and the consequent loss of body weight by ruminants necessitate that farmers embrace the technology of preservation of excess forages obtainable in the wet season to tide over the period of scarcity often experienced in the dry season.

The low nutritive value of tropical grasses and roughages, commonly available for use in ruminant production systems for the tropics, highlights the need for low-cost supplementation to improve productivity. In this context, tree legumes such as *Luecaena*, *Gliricidia* and *Sesbania* are being promoted as protein supplement for livestock. Astonishingly, despite its availability and high protein content, there was little interest until recently to utilize fresh cassava forage in ruminant feeding. Cassava remains one of the most popular locally produced food crops in Nigeria. Cassava is frequently rated low because its roots have low protein content. But unlike the roots that are essentially carbohydrate, cassava leaves are good sources of protein, vitamins which can provide a valuable supplement to the predominantly starchy diets and feeds. Cassava leaves compares favourably with other green vegetable, browse plant (e.g L*eucaena leucocephala, Giliricidia sepium)* generally regarded as good protein sources (Yousuf *et al*., 2007).

Cassava has a unique characteristic in that it can be continuously harvested and marketed throughout the year. Cassava roots are the most common part of cassava used as livestock feed by farmers in the villages. The principal part of the matured cassava plants expressed as a percentage of the whole plant is 6% leaves, 44% stem and 50% root tubers. The roots and leaves of the cassava plant are the two nutritionally valuable parts which offers potentials as a feed resource. The leaf contains high crude protein up to 25 % on dry matter (DM) basis, a nutrient which is generally deficient in feeds for livestock in the tropics. Thus, it can potentially be used as a protein source for livestock. AFRIS (2004) reported a crude protein (CP) content of cassava leaves in the range of 22-29 % of dry matter (DM), whereas Seng *et al.,* (2001) showed that the foliage contained 21-24 % CP. However, cassava leaf production is high during cassava tuber harvest; thus, these are abundantly available only in short periods of time. Feeding such high protein forage as a single feed to ruminants, as commonly practiced by farmers during the season when cassava leaf is abundantly available, is not an efficient feeding practice. This is because the excess protein consumed by ruminants will be excreted mainly in the urine and faeces, and it requires a lot of energy for the animal to metabolize and excrete the excess protein intake in this way (McDonald *et al.,* 2002). Like other forages, cassava leaf cannot stand for long time without any treatment, consequently the excess of cassava leaf are sometimes left in the field underutilized. Ensiling could be a suitable way of preserving the leaves but silage additives should be added to ensure successful fermentation (Pattersson, 1988).This opportunity could solve the problems of feed shortage particularly in the dry season, and at the same time improve feed quality. As silage, the excess cassava leaf available can be stored and utilized for a longer period of time as a protein feed supplement. Hang (1998), Kayouli and Lee (2000), Ly and Rodríguez (2001) reported that silage making is an appropriate method to conserve cassava leaf as feed. Preservation of the excess of cassava leaf will maximize and improve the efficiency of the excess cassava leaf utilization as feed. There is therefore the need to consider the effects of ensiling it in mixture with grasses such as Guinea grass (*Panicum maximum*).

Guinea grass (*Panicum maximum)* is one of the grasses that are abundant and available almost in all parts of the tropics and in almost all ecological zones in Nigeria but scarce in the dry season suggesting the need for conservation. Guinea grass is a tall, vigorous clump forming perennial grass with stems up to 3.5m. It produces high yields of palatable fodder and responds well to manuring but rapidly declines in nutritive values with age (FAO, 2003). However, Guinea grass like any other tropical grass rapidly decline in crude protein and soluble carbohydrate. It increases in crude fiber and lignin which leads to reduction in voluntary intake and digestibility (Bamikole *et al.,* 2004). Ajayi *et. al.* (2008) reported that if grass of any age is effectively managed it can strategically be exploited to ameliorate forage scarcity in the off season. Du Ponte *et al.* (1998) demonstrated that Guinea grass can be successfully ensiled, maintaining nutritive quality and minimal spoilage under tropical climatic conditions.

Silages made from tropical grasses are poor in nutrient because of the low protein content. The production of good quality silage involves making a good balance between carbohydrate and protein content in the raw material. The balance can be obtained by ensiling legumes and grass together. In this way, sufficient fermentable carbohydrate for lactic acid bacteria are provided and simultaneously the protein content of the silage is increased (Assefa and Ledin, 2001; Nayigihuju *et al.,* 2002). In addition, the mixture of legumes and grass will increase biomass yield, crude protein content and the nutritive value of the resultant silage (Assefa and Ledin, 2001; Nayigihuju *et al.,* 2002). The ensiling process ensures not only increased length of storage and microbiological safety but also makes most food resources more digestible (Seng and Rodriguez, 2001).

This study therefore was designed to evaluate the voluntary intake and performance of wad sheep fed ensiled cassava tops and guinea grass mixture.

MATERIALS AND METHODS

Experimental Sites

The experiment was conducted at the Sheep and Goat unit of the Teaching and Research Farm Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Ogbomoso is located in the derived savannah Zone of latitude 8°261N and longitude 4°29f with a mean annual rainfall of 1247mm and mean annual temperature of about 27°C.

Experimental animals and management

Twenty (25) male West African Dwarf sheep age 12-14 months were purchased from local markets around the University farm. The animals were confined for one-month adaptation period. During this period they were treated against ecto and endoparasitic infections Feed, water and salt lick were provided *ad-libitum*.

The animals were housed in individual pens made of low walls of 1 m x 1.5 m in size, well ventilated cement floored pen equipped with feeding and watering troughs with roofs made of corrugated iron sheets. The pens were cleaned, washed thoroughly and further disinfected with Morigad. The feeding and drinking troughs were washed and disinfected and the whole house was left to rest for two weeks before usage. Wood shaving was spread on the floor of the pen as bedding containers.

Animal feeding

The rams were weighed on arrival, rested, watered and tagged for easy identification. Rams were fed with the feedstuff (including maize bran, cassava peels, and wheat offal), which they consumed from where they were purchased during the acclimatization periods. The animals were placed on prophylactic treatment through the administration of antibiotics (long acting). Animal were also treated against endoparasites and ectoparasites using 10% of Levamisol and diazintol respectively. They were allowed to adapt for 1 month, which consists of 4 hr daily grazing and concentrate supplementation.

After adaptation, the animals were randomly grouped into five treatments in a completely randomized design comprising five animals per diet and trial lasted for a one hundred and thirty five (135) days. They were individually kept in separate pens that were previously embedded with wood shavings. Feeders and drinking trough were placed in the pens for free access to feed and fresh water daily. Feed were offered at approximately 4% of their body weight. Voluntary feed intakes were estimated as the difference between feed offered and feed refusal. The animals were weighed prior to feeding to minimize error due to “fill” in the morning on a weekly basis to calculate average weight gain.

Daily feed intake and weekly weight were recorded for each animal.

Experimental diets: In a completely randomized design with five replicate sheep were randomly distributed to treatment diet which was ensiled as follows.

Treatment 1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
Treatment 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
Treatment 3: 60% Guinea grass +30% cassava tops + 10% millet grain.
Treatment 4: 60% Guinea grass +30% cassava tops + 10% sugar
Treatment 5: 60% Guinea grass + 40% cassava tops + 0% additives

Digestibility trials

Fifteen rams were used for determining the digestibility and N-balance of the diets. The animals were housed individually in metabolic cages in a completely randomized design. The animals were offered the feed during seven days adaptation period prior to 7 days collection period; water and salt licks were provided throughout the metabolic period. The animals were weighed at the beginning and end of the digestibility trials. The animals were supplied the experimental diets as in growth trial. During seven days collection period, total faeces were collected and weighed daily. A 10% sample of total faeces was stored in a freezer at – 10 ºC. After 7 day collection period, daily samples from each animal were bulked, mixed, dried in an oven at 60 ºC and milled for chemical analysis. All urine were collected and measured daily in the morning using measuring plastic containers. At collection 2 ml of 10 % sulphuric acid was added to 10 % aliquot of the urine in each container to prevent microbial growth and loss of nitrogen. Ten percent of total urine was sampled daily and stored at – 4 ºC for nitrogen analysis. Daily feed was served at 4 %

body weight. Feed refusal was sampled daily and mixed for the entire collection period on an individual basis using an air tight plastic bag.

Chemical analysis

Dried samples of the experimental diets were analyzed for Crude protein, Dry matter, Ether extract, Ash, calcium and phosphorus contents as described (AOAC, 2005), while the Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Acid Detergent Lignin (ADL) were determined according to the method of Van Soest *et al.* (1991).

Statistical analysis

The experimental design was completely randomized design (CRD). Data generated were subjected to the analysis of variance procedure of SAS (1999). Significant means were separated using the Duncan Multiple range test of the same package.

RESULTS

Chemical composition of ensiled cassava tops and guinea grass mixture

Table 1 shows the chemical composition of ensiled cassava tops and guinea grass mixture with different additives and there were significant (p> 0.05) differences among the different silages. DM content ranged between 27.12g/100g DM in silage with sorghum additive to 28.80g /100g DM in silage with millet additive. CP varied from 21.88g/100g DM in silage with sugar additive to 25.60 g/100g DM in millet additive. The Crude fibre content of the silage was highest in silage with sorghum additive (32.49g/100g DM) but similar to the values obtained in silage with sugar additive (31.95g/100g DM), millet grain (31.91 g/100g DM) and cassava chips (31.89 g/100g DM) and differed significantly (P<0.05) from silage with no additive (31.12 g/100g DM). Ash was highest in silage with no additive (9.62 g/100g DM) and lowest in silage with sugar additive (7.56g/100g DM). The NDF content of the silage ranged between 68.81and 76.39g/ 100gDM while ADF ranged between 40.64 and 48.06g/ 100g DM.

Table 1: Effects of additives on chemical composition (g/100g DM) of ensiled cassava tops and Guinea grass mixture

Treat Treatment	Dry matter	Crude protein	Crude fiber	Ash	NDF	ADF	Ether extract
T1	28.80^{a}	23.74^{ab}	31.89^{a}	9.42^{a}	71.66^{b}	43.44^{c}	8.41^{b}
T2	27.12^{c}	23.85^{ab}	32.49^{a}	8.51^{b}	71.47^{b}	44.48^{b}	8.32^{b}
T3	28.80^{a}	25.60^{a}	31.91^{a}	9.41^{a}	76.39^{a}	40.64^{d}	10.13^{a}
T4	27.52^{bc}	21.88^{b}	31.95^{a}	7.56^{c}	69.39^{c}	44.81^{bc}	8.83^{b}
T5	28.06^{b}	24.94^{a}	31.12^{b}	9.62^{a}	68.81^{c}	48.06^{a}	8.39^{b}
SEM	0.18	0.75	0.20	0.14	0.39	0.31	0.16

ab means on the same column with different superscripts are significantly different (P<0.05)
SEM= Standard Error Mean
T1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
T 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
T3: 60% Guinea grass +30% cassava tops + 10% millet grain.
T 4: 60% Guinea grass +30% cassava tops + 10% sugar
T 5: 60% Guinea grass + 40% cassava tops + 0% additives

The performance characteristics of WAD sheep fed on ensiled cassava tops and guinea grass mixture are shown in Table 2. The final body weight (kg) and dry matter intake (g/day) of rams on different silages were significantly ($P < 0.05$) different from each other, with ram from treatment 3 having the highest value. The diets had no influence on the body weight gain (kg) and daily body weight gain (g/day). Animals on treatment 3 (41.67 g/d) showed the best body weight increase while animals from treatment 4 (30.93 g/d) showed the least. The values for dry matter intake ranged from 459.28 to 530.01 g/day. The silages with different additive had no significant ($P < 0.05$) effect on the Feed conversion ratio (FCR) of the ram.

Apparent digestibility (%) of ensiled cassava tops and Guinea grass mixture by WAD sheep is shown in Table . The Dry matter, Crude protein, crude fibre and ether extract differ significantly ($P < 0.05$) among the diets while Ash and organic matter digestibility were not significantly ($P > 0.05$) affected. The highest DM, CP and CF digestibility value were recorded in treatment 5 (84.69, 90.58 and 70.97% respectively) and the lowest were recorded from treatment 4 (75.78, 84.14 and 83.50% respectively). The ether extract digestibility was highest in treatment 2 (89.14%) and lowest from treatment 4 (73.31 %).

Table 2: Performance characteristics of WAD sheep fed on ensiled cassava tops And guinea grass mixture

Parameter	T1	T2	T3	T4	T5	SEM
Initial body weight(kg)	13.25	13.50	13.63	13.63	13.00	
Final body weight(kg)	17.43^{ab}	18.13^{ab}	19.25^{a}	16.75^{b}	17.76^{b}	0.66
Body weight gain(kg)	4.13	4.63	5.63	4.13	4.56	0.59
Daily body weight gain (g/d)	30.93	34.26	41.67	30.56	33.80	
Dry matter intake, total (g/d)	483.89^{b}	487.92^{b}	530.01^{a}	459.28^{c}	472.59^{bc}	4.39
Dry matter intake, total, metabolic (g/kgW0.75)	103.16^{b}	103.82^{b}	110.45^{a}	99.20^{c}	101.36^{bc}	1.07
Feed conversion Ratio	15.99	15.34	12.96	16.04	14.89	1.87

ab means on the same row with different superscripts are significantly different ($P<0.05$)

SEM= Standard Error Mean

T1: 60% Guinea grass +30% cassava tops + 10% cassava chips.

T 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.

T3: 60% Guinea grass +30% cassava tops + 10% millet grain.

T 4: 60% Guinea grass +30% cassava tops + 10% sugar

T 5: 60% Guinea grass + 40% cassava tops + 0% additives

Table 3: Apparent digestibility (%) of ensiled cassava tops and Guinea grass mixture by WAD sheep

Treatment	Apparent digestibility					
	Dry matter	Crude protein	Crude fibre	Ash	Organic matter	Ether extract
T 1	80.06^{ab}	87.25^{ab}	79.46^{ab}	60.62	82.01	82.62^{c}
T 2	82.29^{ab}	89.48^{ab}	80.04^{ab}	59.02	84.13	89.41^{a}
T3	76.87^{ab}	87.25^{ab}	74.86^{ab}	55.38	79.13	84.58^{bc}
T 4	75.78^{b}	84.14^{b}	70.97^{b}	49.08	78.20	73.31^{d}
T5	84.69^{a}	90.58^{a}	83.50^{a}	68.31	85.95	88.75^{ab}
SEM	2.52	1.80	2.96	6.53	2.28	1.42

abcd Means on the same column with different superscript, differ significantly (P< 0.05);
SEM= Standard Error Mean
T1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
T 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
T3: 60% Guinea grass +30% cassava tops + 10% millet grain.
T 4: 60% Guinea grass +30% cassava tops + 10% sugar
T 5: 60% Guinea grass + 40% cassava tops + 0% additives

Table 4 shows the total digestible nutrients (TDN) in the silage with different additives. The TDN ranged from 79.49 to 86.71. The silage with no additive had the highest TDN value of 86.71 while the one with sugar additive had the least TDN value of 79.49. There were significant differences among the TDN in the silages but none between silages with cassava chips and sorghum additive and no additive. Similarly the difference between the TDN in the silages with millet, Cassava chips and sorghum were not significant.

Table 4: Total digestible nutrients by WAD sheep fed ensiled cassava tops and Guinea grass mixture

PARAMETERS (%)	T1	T2	T3	T4	T5	SEM
Crude protein	15.82^{ab}	16.40^{ab}	16.73^{ab}	14.78^{ab}	17.17^{ab}	0.58
Crude fibre	23.95^{ab}	24.50^{ab}	23.71^{a}	21.57^{ab}	26.36^{ab}	1.81
Ether extract	3.87^{ab}	4.40^{ab}	4.75^{a}	3.48^{ab}	4.15^{ab}	0.37
Nitrogen free extract	34.29	35.11	30.18	35.30	33.83	1.56
Total digestible Nutrient	82.76^{abc}	85.91^{ab}	81.31^{b}	79.49^{c}	86.71^{a}	1.59

ab means on the same row with different superscripts are significantly different (P<0.05)
SEM= Standard Error Mean
T1: 60% Guinea grass +30% cassava tops + 10% cassava chips.
T 2: 60% Guinea grass +30% cassava tops + 10% sorghum grain.
T3: 60% Guinea grass +30% cassava tops + 10% millet grain.
T 4: 60% Guinea grass +30% cassava tops + 10% sugar
T 5: 60% Guinea grass + 40% cassava tops + 0% additives

DISCUSSION

The effect of the different additive was significant on the chemical composition of the silage Silage with DM content between 25 and 35% are considered to be good (Patterson 1998).

Protein is limiting in grass and therefore, there is a need for supplementation of grass silage with richer protein sources. Grass silage in Nigeria can be fortified with energy or protein sources by ensiling with cassava leaf, browse pods and industrial by-products. In order to enhance the CP supplementation for WAD goats, Igbekoyi (2008) ensiled Guinea grass with *Albizia saman* pods to obtain 14-18% CP. The CP exhibited within the range (21.88 and 25.60 g/100 g DM) reported was lower than those reported by Oluwadamilare (1997) who reported 31.9% CP for cassava/Guinea grass mixtures and Oduguwa *et al.* (2007) but similar to what Kavana *et al.* (2005) who reported 21.86% for cassava leave silage. The variations could be attributed to difference in varieties as well as the stage at which the crop was harvested, soil fertility, climate and sampling procedure. Variations in crude fiber level could be due to stage of maturity

Consequently, the CP content (21.88-25.60 %) of the silage was higher than 11–12% suggested by NRC (1985) as adequate to meet requirements of growing sheep, and was not below the level at which it could be considered deficient (Norton, 1994) and the recommended for moderate growth of early-weaned sheep (NRC, 2001).

NDF and ADF concentrations of the forage were much higher than recommended values of 25% for ruminants (NRC, 2001). However, their concentrations were not too high to hinder intake and animal production (Meissner *et al*., 1991; Buxton, 1996). Acid detergent fibre is inversely correlated with the digestibility of a feed; the lower the ADF, the higher the digestibility. Neutral detergent fibre (NDF) is correlated with the level of dry matter intake by ruminant; the lower the NDF, the higher the level of intake. The NDF content reported in this experiment was higher than results from Oduguwa *et al.* (2007), but ADF was in the range reported. Ensilage had average effect on the structural carbohydrate. Stage of Maturity is the major factor contributing to the variability in fibre content. The chemical composition of the silage suggests that any of the additives could be used but this will depend on their availability and cost.

Dry matter intake (DMI) is an important factor in the utilization of feed by ruminants and is a critical determinant of energy intake and performance (Devendra, 1997). The DMI is known to be a basic limiting factor in feed utilization since this governs the quality of intake of every other nutrient in the feed and invariably the overall performance of the farm animals. The high dry matter intake (DMI) of rams on the silages with different additives could be as a result of the succulent nature of the silage coupled with the high CP content. The level of DMI is influenced by several factors, such as body composition of animals (composition of body fat), environmental conditions especially climate, genetic factors, weight of animals, type of management, feed composition and quality (ARC, 1985). Dry matter intake was high. This could be as a result of the succulent nature of the silage coupled with it higher CP content. However, it has been observed that DMI could be favorably influenced by dietary CP level (Karim *et al*., 2001; Karim and Santra, 2003).Overall, DMI of sheep were within the 310 to 870 g/day values reported by ARC (1985) and McDonald *et al*. (1987) as adequate for sheep with body weight of 20 to 35 kg. However NRC (1985) reported that DMI could go up to 1000 to 1300 g/day for growing sheep. Some factors, e.g. low pH (Shaver *et al*., 1985) as well as high contents of acetic acids (Wilkins *et al*., 1971) and lactic acids (Mc Leod *et al*., 1970) have been attributed to the reduced intake of silage.

Feed intake is an important nutritive indices that determine weight gain in livestock . Animals with higher feed intake were likely to have also consumed more nutrients thus making more energy and nutrients available for tissue utilization. This is in agreement with the report of Njidda (2008) that an efficient utilization of feed supplying adequate energy and protein is required for optimum growth performance in ruminant. Olafadehan *et. al.,* (2014) earlier reported that nutrient is a function of DM intake. Feed intake was observed to be the highest in rams on treatment 3 which may have contributed to the animals highest daily weight gain. This shows better utilization of feed by rams on this silage and also had the best feed conversion ratio when compared with the rams on other silages. This may be attributed to low dietary CF and high dietary CP content which is believed to stimulate feed intake (Huston, *et al.,* 1988)

Variations in feed intake can be attributed to differences in breed, body weight, type of diet and length of time spent on the diet. Matthewman [21] also stated that feed intake is greatly influenced by the palatability of the feed and animals' level of productivity.

Feed conversion (FCR) differed significantly across the treatment meaning that the different additives had effects on the animals. The higher the FCR, the less desirable or efficient is the silage

Factors which influence FCR among other include breed, age and sex of animals as well as nutrition and environment. High feed conversion ratio usually indicates poor ability of animals to maximize feed by failure to optimally utilize feed for meat production. Rams on treatment 3 performed better in terms of feed conversion ratio.

Ensiled cassava tops and guinea grass mixture increased total N supply and together with an increase in diet digestibility would have contributed to better performance in the supplemented groups. According to several authors it is likely that the increasing CP intake leads to an increased bacterial population in the rumen, thereby increasing the availability of fermentable nitrogen, and later to an improved digestion of fibre in the rumen (McDonald *et al*., 1998; Ash,1990; Khang and Wiktorsson, 2004).

Feed type is an important factor that affects sheep growth and performance. Andrews and Orskov (1970) reported that ADG of growing lambs improved as dietary protein level increased in the diets. Our observation on the influence of CP content on ADG is in agreement with Kanjanapruthipong and Leng (1997), Warly *et al*. (1994), Hossain *et al*. (1995) and Thu and Uden (2001) who reported that the level of protein in the diets would improve DMI, digestibility and maximizes efficiency of microbial cell synthesis in the rumen for live-weight gain.

According to FAO (1995), the energy value of silage and the efficiency of its utilization, are largely determined by the relative balances of glucogenic energy, long chain fatty acids and essential amino acids absorbed by the animal. It could then mean that this diet contained a balance of nutrients, which efficiently interacted to give the highest average daily gain. Sainz and Wolff (1990) reported that the rate of fat deposition relate more to the amount of energy available in excess of requirements for maintenance and lean growth. Variation in average daily gains of the rams could be attributed to variation in nutrient supply in the silage (Oddy and Sainz, 2002). Daily body weight gain (g/d) ranged between 30.9 to 41.7 g/d but lower than findings of Marjuki *et al., (2008*) who reported between 41.4 to 45.0 g/d. Feeding cassava leaf silage has been reported to increase body weight gain (Nhi *et al.,* 2001 and Bunyeth and Preston, 2006). Alli-Balogun *et al.,* (2003) fed 1.0% and 1.5% of body weight equivalent of cassava leaf to Yankasa sheep as supplement to Gamba grass and recorded weight gain of 39.2-41.2 g/d. Andrews and Orskov (1970) reported that ADG of growing lambs improved as dietary protein level increased in the diets. Our observation on the influence of CP content on ADG is in agreement with Kanjanapruthipong and Leng (1997), Warly *et al*. (1994), Hossain *et al.* (1995) and Thu and Uden (2001) who reported that the level of protein in the diets would improve DMI, digestibility and maximizes efficiency of microbial cell synthesis in the rumen for live-weight gain.

Food and agriculture organization (1995) classified digestibility of feed as; high (> 60%), medium (40-60%) and low (< 40%). Apparent digestibility was high for all the nutrients except the medium value obtained for ash. The Dry matter digestibility (DMD) in the present study was higher than the value (71% DMD) obtained by (Wanapat *et al*., 1997) for cassava tops hay and 50% DMD observed by (Man and WIktorsson, 2001). This difference could be as result of stage of maturity, preservation method and additive inclusion may explain the difference. The higher crude protein (CP) digestibility of animals fed with the different silage could be attributed to the amount of cassava tops which is the primary source of protein in the diet. The high intake resulting in higher protein digestibility may be connected to the nature of the silage. High crude protein in the diet has been considered an important factor that enable high intake of the silage Crude protein digestibility was higher than 47.2% reported by Taiwo *et al*., (1995). Digestibility of CP often increases as CP intake decreases because metabolic faecal N usually makes up a larger part of faecal N at low intake than at high intake (Wheeler *et al*., 1975). The daily DM intake and apparent DM digestibility showed a continuous increase with increasing levels of wilted cassava foliage in the diets which is a logical consequence of the increasing CP content in the diet. Ash digestibility signifies that animals were able to utilize the mineral in the feed efficiently. The improved nutrient digestibility of the ram might be due to their relatively low fibre but high nitrogen content that facilitated the growth and activity of rumen microorganisms (Adu and Olaloku, 1976). The different silage mixture had CP that supported high DMI, digestibility and possibly microbial protein synthesis.

The TDN obtained in this study was above the TDN values of 70.6%, 70.7% 66.7% from corn silages (Nishida *et al*., 2007). This suggests that cassava tops based silage compares favourably with silage made from corn in terms of TDN and can serve as an alternative replacement to the expensive conventional corn silage there by reducing the cost of production. Adequate nutrition is essential to ruminant. They prefer feedstuffs with relatively high crude fiber, the feedstuff should also contain considerable total digestible nutrients (TDN)) Williamson and Payne, 1987)

CONCLUSION

The results from this study have demonstrated that ensiled cassava tops and guinea grass mixture with different additives promote efficient nutrient utilization and performance by WAD sheep. These may be due to the nutrients quality of the additives and also the acceptability of the diets with additives by the animals probably because of the flavour and nutrients. Suggesting its usefulness as nutritious and palatable diets for ruminants. Since optimal performance of animals fed with ensiled cassava tops and guinea grass mixture affirms the efficiency of the diets to the animals. It can thereby be concluded that supplementation of cassava chips as an additive in ensiled cassava tops and guinea grass will improve the performance of the WAD rams.

Since guinea grass (*Panicum maximum*) and cassava tops is available all year round in Nigeria, it can be preserved as silage (for ready use) and it will go a long way in the sustaining the animals during off-seasons. Silage is also economical because it saves the stress of buying conventional feed during dry season.The use of suitable additives that can furnish and give silage good taste and aroma is a pre-requisite to proper ensiling process.

There is needed to be mindful of the stage of growth of the grass for silage production because guinea grass losses its nutrient as it grows.

Conclusively, the addition of cassava tops and millet grains as additives in Guinea grass silage improved average daily weight gain and feed conversion ratio when compared to the others and therefore the silage with millet additive is recommended. Graded level of millet can be used in further studies to ascertain the optimum level for best level and to reduce cost of producing the silage

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